Citation:

Greene LF, Malpede CZ, Henson CS, Hubbert KA, Heimburger DC, Ard JD. Weight maintenance two years after participation in a weight loss program promoting low-energy density foods. *Obesity* (Silver Spring). 2006 Oct; 14 (10): 1,795-1,801.

PubMed ID: 17062810

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- The primary aim was to determine weight outcomes for a sample of participants at least one year after completing University of Alabama Birmingham's EatRight Weight Management Program
- The secondary aim was to determine dietary intake patterns that are associated with various patterns of weight change after participation.

Inclusion Criteria:

- Participants from the University of Alabama Birmingham (UAB) EatRight Weight Managment Program database
- Participants who had attended three or more classes
- Participants from the years 2001 to 2003 who had not participated in the program again since that time
- Completion of a four-day food record (two weekdays and two weekend days).

Exclusion Criteria:

- Self-report of any ongoing condition or illness that may have contributed to or caused significant weight gain or loss (e.g., pregnancy, cancer)
- Participation in fewer than three classes
- Participation in the program in years other than 2001 to 2003
- Lack of a four-day food record.

Description of Study Protocol:

Recruitment

- Study participants were recruited from the UAB EatRight Program database
- Potential participants were contacted by a phone call, e-mail or letter mailed to their home address
- Potential participants were told that the EatRight program was conducting follow-up measurements of former participants to complete program evaluation
- All potential participants were offered a $25 travel reimbursement and a choice of an additional incentive valued at $25 (discounts to local businesses or a cookbook).

Design

- A cohort study of participants in the UAB EatRight Weight Management Program
- Data collection includes:
  - Four-day food records
  - Height and weight measurements.

Dietary Intake/Dietary Assessment Methodology

- Dietary intake was estimated from a four-day food record that included two weekdays and two weekend days
- Participants completed the food records before coming in for their follow-up visit
- Food records were analyzed usign the University of Minnesota Nutrition Data System for Researh (version 5.0)
- The percentage of recommended Food and Drug Administration (FDA) serving size consumed was determined by dividing

the amount of food (g) by FDA serving size (g)
    - FDA serving size was calculated for:
        - Meat and dairy
        - Fats and nuts
        - Fruits
        - Vegetables
        - Grains
        - Caloric beverages, excluding milk
- Energy density was calculated as energy density from food only as energy (kcal) per weight of food (g)
- Beverages, including milk, alcohol, other caloric drinks and non-caloric drinks were removed from the dataset.

Statistical Analysis

- Descriptive statistics were calculated for all study participants using SPSS/PC statistical program
- Weight maintenance was defined as gaining less than 5% of body weight since completion of the EatRight program and staying below the initial weight at the time of entry into the program
- Those who gained 5% or more of their body weight since completion were classified as gainers
- Unadjusted means were calculated for calcories, giver and percentage of calories from fat, carbohydrate, protein and saturated fat between maintainers and gainers using Student's T-tests
- Correlations between weight status and dietary intakes were obtained using Spearman correlations
- Adjusted means were compared using general linear modeling with covariates of age, gender, weight at completion of EatRight and length of follow-up.

Data Collection Summary:

Timing of Measurements

- Body weight was measured at entry, during and completion of UAB's 12-week EatRight program during 2001 to 2003. It was also measured at the follow-up visit between January 2004 and January 2005.
- Dietary intake was assessed through food records completed prior to participants' follow-up visits.

Dependent Variables

BMI (calculated as kg/m^2; body weight was measured in light clothing without shoes).

Independent Variables

- Calories (kcal per day)
- Calories from carbohydrate (percent)
- Calories from protein (percent)
- Calories from fat (percent)
- Calories from saturated fat (percent)
- Polyunsaturated-to-saturated fat ratio (P-to-S ratio)
- Fiber (grams per day)
- Energy density, food only (kcal per day)
- Food weight (g)
- Meat and dairy (amount of food in grams per FDA serving size in grams x 100)
- Fats and nuts (amount of food in grams per FDA serving size in grams x 100)
- Fruits (amount of food in grams per FDA serving size in grams x 100)
- Vegetables (amount of food in grams per FDA serving size in grams x 100)
- Grains (amount of food in grams per FDA serving size in grams x 100)
- Beverages (excluding milk and water; amount of food in grams per FDA serving size in grams x 100).

Control Variables

- Age
- Gender
- Weight at completion of EatRight
- Length of follow-up.

Description of Actual Data Sample:

- *Initial N:* 74 (82.4% women)
- *Attrition (final N):* 71
- *Age:* Average age 50 years; Range 38.6 to 64.4 years

- *Ethnicity:* The majority of the participants (81%) were white. No other information is provided about race or ethnicity
- *Anthropometrics:* During EatRight, participants lost an average of 4.0kg, making the mean BMI after participation 32.3kg/m^2
- *Location:* University of Alabama at Birmingham.

Summary of Results:

Primary Findings

- After a mean follow-up time of 2.2 years, the average weight change was an increase of 0.59kg (mean BMI, 32.5kg/m^2)
- The distribution of change in weight over time did not show a trend toward significant weight regain for the population
- The mean daily dietary intake of the 71 participants with complete food records was 1,695 calories, with 36% calories from fat, 48% from carbohydrate and 16% from protein
- Of the 74 participants, 78.4% were maintainers and 21.6% were gainers at follow-up
- Compared to those who gained weight, maintainers' unadjusted intakes were significantly lower in total calories, energy density and percentage of calories from fat and saturated fat
- After adjustment for age, gender, body weight at the completion of the EatRight program, and length of follow-up time, only energy density remained significantly lower in maintainers
- Total calories, saturated fat calories, and P-to-S ratio showed a trend toward a significant difference
- A lower total intake of total calories, energy density and calories from fat and saturated fat was significantly correlated with maintaining weight loss, as was a higher intake of calories from carbohydrates and a higher P-to-S ratio.

Characteristics of the Dietary Patterns of Maintainers and Gainers

Nutrient Category	Means Total Sample (N=71)	Maintainers (N=56) Unadjusted	Maintainers (N=56) Adjusted*	Gainers (N=15) Unadjusted	Gainers (N=15) Adjusted*	Adjusted Difference (Maintainers-gainers)	P for Adjusted Difference	Correlation Coefficient for Nutrient and Weight Gain
Calories (kcal per day)	1,695	1,608	1,776	1,989	2,020	-244	0.058	0.285**
Calories from carbohydrate (%)	48	50	49	45	46	3	0.263	-0.239**
Calories from protein (%)	16	16	17	16	16	1	0.564	-0.029
Calories from fat (%)	36	34	33	38	36	-3	0.153	0.318***
Calories from saturated fat (%)	11.1	10.0	10.5	13	12.1	-1.6	0.064	0.354***
P-to-S ratio	0.70	0.78	0.78	0.56	0.62	0.16	0.084	-0.303**
Fiber (g per day)	18.2	18.8	19.9	15.7	17.2	2.7	0.266	-0.177
Energy density, food only (kcal per day)	1.67	1.58	1.67	2.01	1.98	-0.31	0.016	0.241***
Food weight (g)	2,506.6	2,491.6	2,579.1	2,562.2	2,538.4	40.7	0.885	-0.012

*General linear models adjusted for age (51.9 years), gender, weight at completion of program (89.1kg) and length of follow-up (820.3 days)
**P<0.05
***P<0.01.

Mean Percentage of Recommended FDA Serving Size Consumed by Former EatRight Participants*

Food Groups	Population	Maintainers	Gainers	Group Differences in Serving Size Proportion (Maintainers-gainers)
Meat and dairy	107	103	120	-17**
Fats and nuts	93	83	144	-61**
Fruits	81	79	108	-29**
Vegetables	94	96	85	11
Grains	97	95	106	-11
Beverages (excluding milk and water)	148	138	185	-47**

FDA: Food and Drug Administration
* Amount of food in grams per FDA serving size in grams x 100
**P<0.05.

Other Findings

- Weight loss during the program was 1.14kg greater for gainers than maintainers
- The overall mean weight change of all volunteers in this study was a gain of 0.59kg
- The maintainers group included 34 participants who lost weight during the follow-up time period. When compared with others in the maintainer group, those who lost weight during follow-up had similar dietary intake patterns as maintainers.

Author Conclusion:

- Low-energy dense food consumption, particularly unlimited intake of fruits and vegetables may be a valuable method for promoting long-term success with weight control
- Further analyses are needed to understand the impact of other lifestyle factors such as physical activity on long-term weight maintenance when combined with this type of dietary pattern.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes

1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A

	5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**		Yes
	6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
	6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
	6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
	6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
	6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
	6.6.	Were extra or unplanned treatments described?	N/A
	6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
	6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**		Yes
	7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
	7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
	7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
	7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
	7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
	7.6.	Were other factors accounted for (measured) that could affect outcomes?	N/A
	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes

10.2.	Was the study free from apparent conflict of interest?	Yes